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Geology and Mineral-Resource Potential of Seven Roadless Areas in the Apalachicola National Forest, Liberty County, Florida

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U.S. GEOLOGICAL SURVEY BULLETIN 1587

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Geology and Mineral-Resource Potential of Seven Roadless Areas in the Apalachicola National Forest, Liberty County, Florida

By SAM H. PATTERSON, CORNELIA C. CAMERON, and WALTER SCHMIDT

Elevations of the Mineral Potential of the Post Office Bay, Black Creek Islands, Bay Creek, Providence, Mud Swamp–New River, Long Bay, and Gum Bay Roadless Areas

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DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

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STUDIES RELATED TO WILDERNESS

STUDY AREAS

Under the provisions of the Wilderness Act (Public Law 88–577, September 3, 1964) and related acts, the U.S. Geological Survey has been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System and have been studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of mineral surveys of the Post Office Bay (Forest Service number 08–100), Black Creek Islands (08–101), Bay Creek (08–102), Providence (08–103), Mud Swamp–New River (08–008), Long Bay (08–104), and Gum Bay (08–105) Roadless Areas in the Apalachicola National Forest, Liberty County, Florida. The Mud Swamp–New River Roadless Area was established as a Wilderness by Public Law 98–430, September 28, 1984. The other six areas were classified as nonwilderness during the Second Roadless Area Review and Evaluation (RARE II) by the Forest Service in January 1979.

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Geology and Mineral-Resource Potential of Seven Roadless Areas in the Apalachicola National Forest, Liberty County, Florida

By Sam H. Patterson[1], Cornelia C. Cameron[1], and Walter Schmidt[2]

Mineral-Resource Potential Summary Statement

The Post Office Bay, Black Creek Islands, Bay Creek, Providence, Mud Swamp–New River, Long Bay, and Gum Bay Roadless Areas, which will be referred to as the "Seven Roadless Areas" in this report, are underlain by sedimentary rocks having low potential for oil and gas minerals. The low potential for oil or gas notwithstanding, the possibilities for discovery cannot be ruled out because the Seven Roadless Areas and nearby lands have not been explored thoroughly. No minerals have been mined within the Seven Roadless Areas, and the only production in the Apalachicola National Forest in recent years has been the digging of clayey sand used in road construction and in stabilizing U.S. Forest Service roads. Fuller's earth, quartz sand and gravel, clayey sand, and common clay presently are produced elsewhere in the region, and limestone and peat have been produced in the past. No clay suitable for structural clay products or fuller's earth is present in the Seven Roadless Areas; however, a bed of quartz sand and gravel of excellent quality was penetrated by drill and auger holes in the region. Although this bed is coarser grained and, therefore, is more suitable for many uses that the sand deposits worked elsewhere in the Big Bend region, its mineral-resource potential is reduced by the thickness of overburden above it and by its distance from markets in population centers. The Apalachicola National Forest has been explored for phosphate and reconnoitered for heavy minerals, but no valuable deposits of either have been found.

INTRODUCTION

The Seven Roadless Areas are in the southern part of the western one-half of the Apalachicola National Forest (fig. 1), which is in the Big Bend region of the Florida Panhandle (fig. 2). Of the Areas, Gum Bay is the largest, and Bay Creek is the smallest (table 1). Florida Highway 65 extends between the Post Office Bay and the Black Creek Islands Areas. The southern boundaries of both areas are less than 1 mile (mi) north of the town of Sumatra, which is on Florida Highway 65. Florida Highway 67 extends along the eastern boundary of the Long Bay Area, which is the easternmost of the Seven Areas. These Areas (figs. 3–9) can be reached by State highways and U.S. Forest Service roads, which extend along the boundaries of nearly all the Seven Areas.

Other areas in the Apalachicola National Forest have been investigated by the U.S. Geological Survey (USGS) and the U.S. Bureau of Mines (USBM). During the last several years, the Savannah (Patterson, Schmidt, and Crandall, 1982) and Clear Lake (Hendry and others, 1982) Roadless Areas and the Bradwell Bay Wilderness and the Sopchoppy River Study Area (Cameron and Mory, 1977) have been studied.

The Roadless Areas are in a flat swampy region of the Coastal Plain. The highest point in the Seven Areas is the 70-foot (ft) altitude along the northern boundary of the Long Bay Area (fig. 8). The lowest altitudes are a little less than 20 ft where Black Creek crosses the southern boundary of the Black Creek Islands Area (fig. 4), where the New River crosses the southern boundary of the Mud Swamp–New River Area (fig. 7), and where Juniper Creek crosses the southern boundary of the Gum Bay Area (fig. 9). The New River and the large creeks in the Seven Areas are anastomosing streams choked with vegetation. The swamps support cypress, black gum, white cedar, titi with cypress, and grass vegetation types. The scattered dry and intermittently dry areas are characterized by pine-palmetto and savannah vegetation.

Previous Investigations

No detailed geologic studies had been made in Liberty County before the thorough investigations by the Florida Bureau of Geology that began with a drilling program in summer 1981. Crystalline rocks at depth in the region are discussed by Milton (1972) and outlined by Puri and Vernon

[1]U.S. Geological Survey.
[2]Florida Bureau of Geology.

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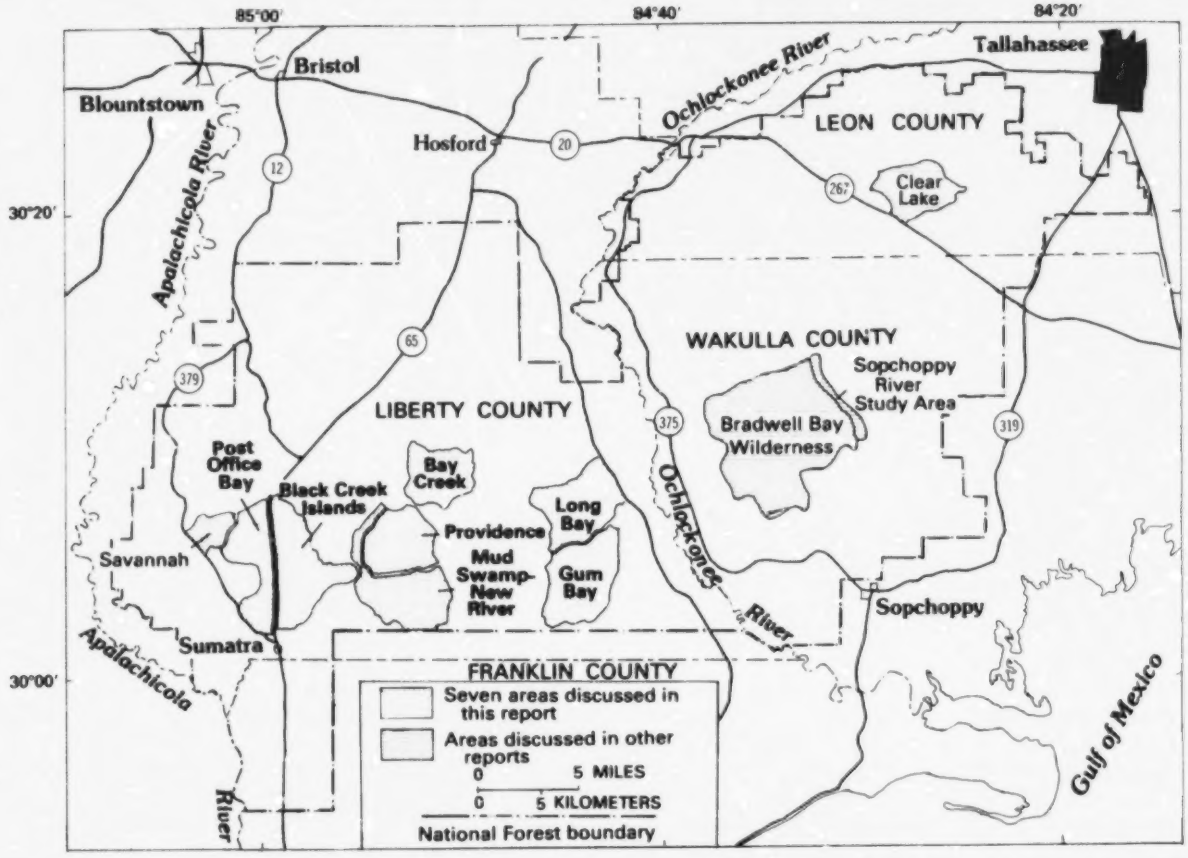

Figure 1. Location of the Roadless and Wilderness Areas in the Apalachicola National Forest, Liberty, Leon, Franklin, and Wakulla Counties, Florida.

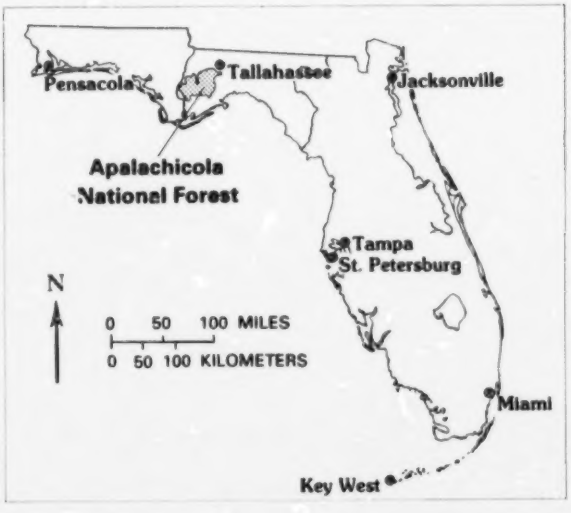

Figure 2. Location of the Apalachicola National Forest, Florida.

Table 1. Acreages of the Seven Roadless Areas, Apalachicola National Forest

[Source: U.S. Forest Service, Tallahassee, memorandum, September 16, 1983]

Area	Area number	Gross acres	Net acres
Post Office Bay	08–100	7,489	7,219
Black Creek Islands	08–101	8,426	8,270
Bay Creek	08–102	5,513	5,513
Providence	08–103	6,681	6,681
Mud Swamp–New River	08–008	8,018	8,018[1]
Long Bay	08–104	8,055	8,005
Gum Bay	08–105	8,513	8,513
Total		45,206	45,050

[1]Public Law 98–430, September 28, 1984, gives the area in the Mud Swamp–New River Roadless Area as approximately 7,800 acres.

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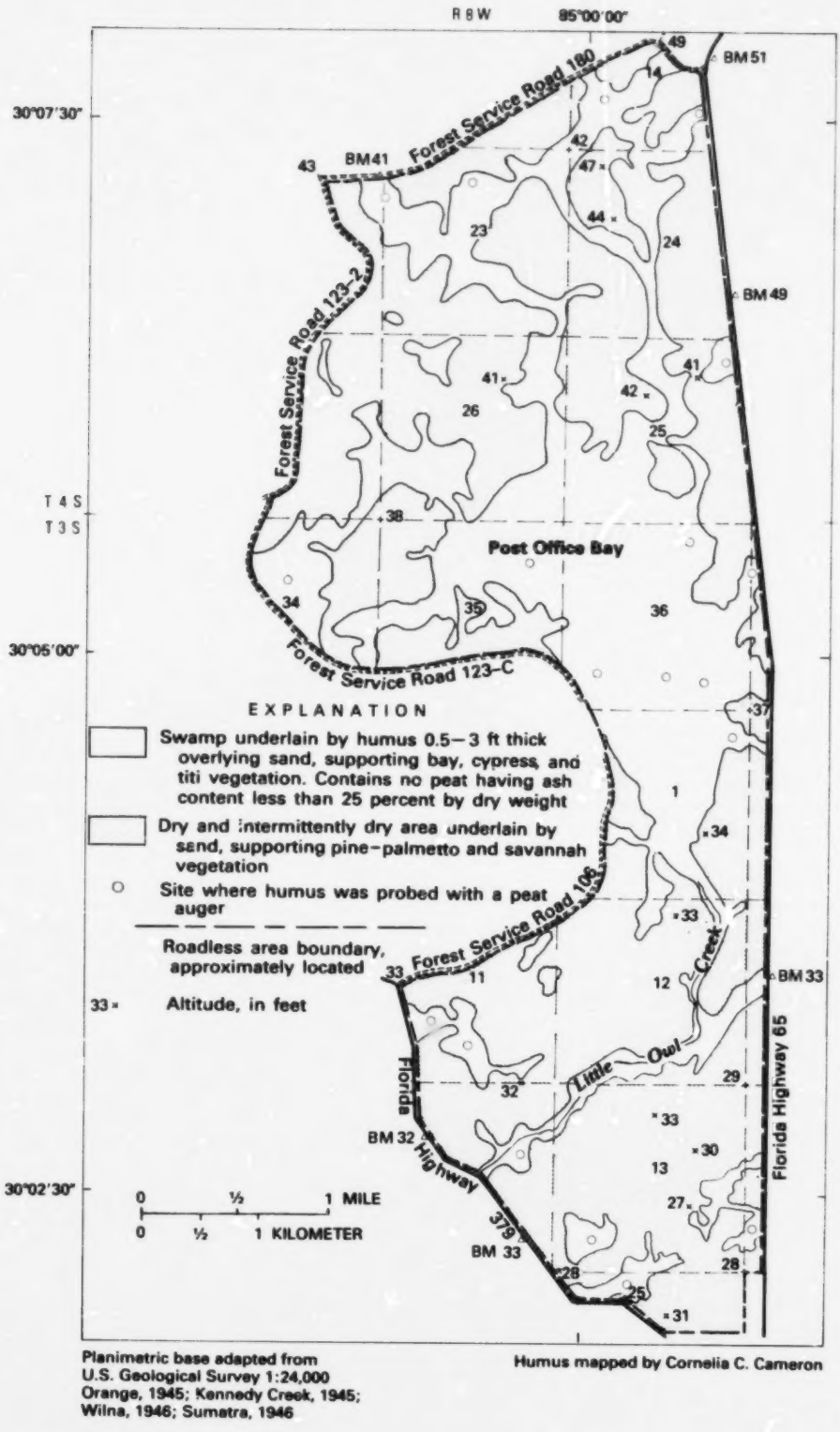
R 8 W
85°00'00"
30°07'30"
30°05'00"
30°02'30"
T 4 S
T 3 S
Forest Service Road 180
Forest Service Road 123-2
Forest Service Road 123-C
Forest Service Road 106
BM 51
BM 49
BM 41
BM 33
BM 32
Post Office Bay
Little Owl Creek
Florida Highway 65
Florida Highway 379
EXPLANATION
Swamp underlain by humus 0.5–3 ft thick overlying sand, supporting bay, cypress, and titi vegetation. Contains no peat having ash content less than 25 percent by dry weight
Dry and intermittently dry area underlain by sand, supporting pine–palmetto and savannah vegetation
Site where humus was probed with a peat auger
Roadless area boundary, approximately located
33 × Altitude, in feet
0 ½ 1 MILE
0 ½ 1 KILOMETER
Planimetric base adapted from U.S. Geological Survey 1:24,000 Orange, 1945; Kennedy Creek, 1945; Wilna, 1946; Sumatra, 1946
Humus mapped by Cornelia C. Cameron

Figure 3. The Post Office Bay Roadless Area, Apalachicola National Forest, Florida.

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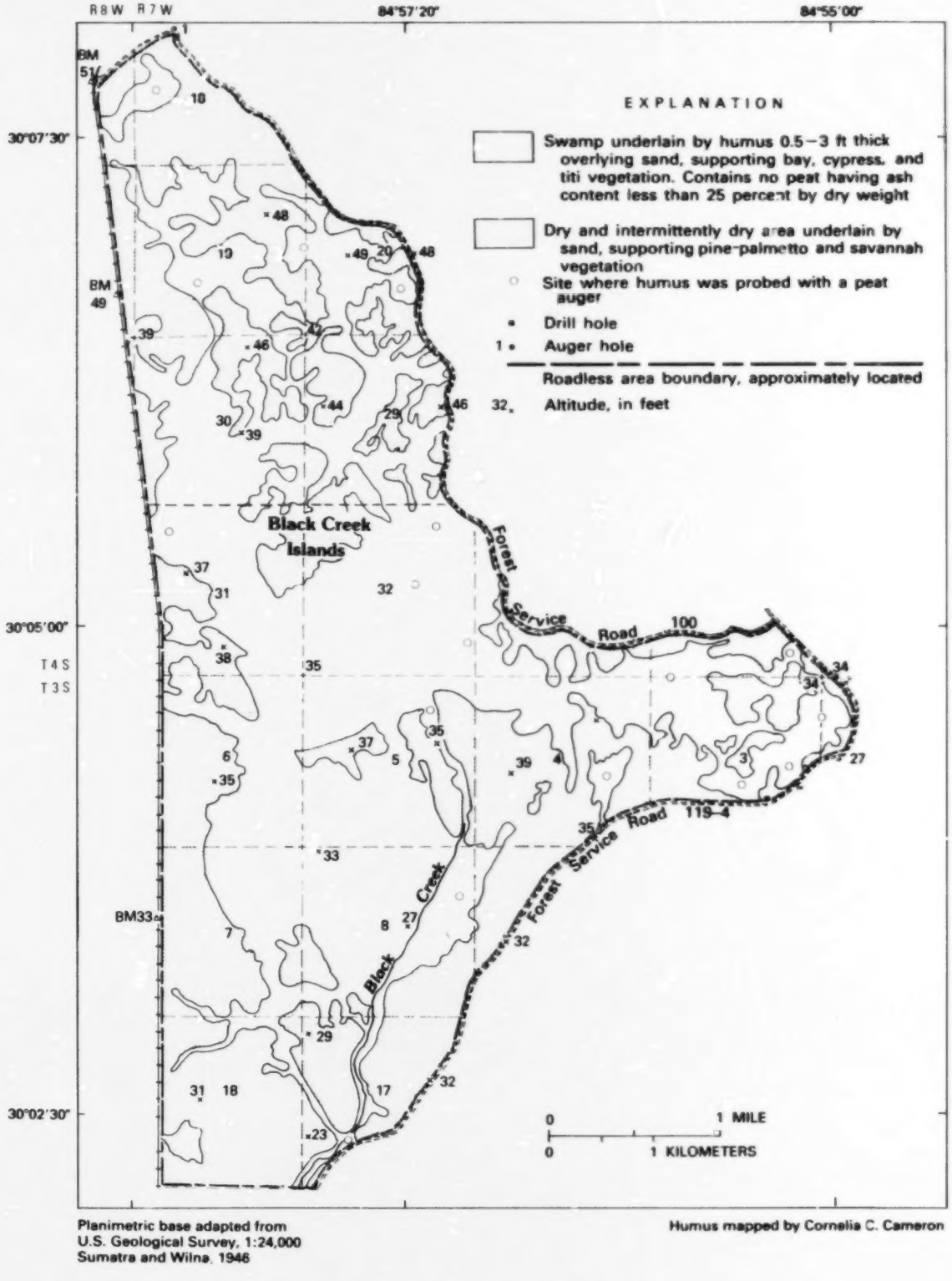
R8W R7W
84°57'20"
84°55'00"
30°07'30"
30°05'00"
30°02'30"
T4S
T3S
BM 51
BM 49
BM33
EXPLANATION
Swamp underlain by humus 0.5–3 ft thick overlying sand, supporting bay, cypress, and titi vegetation. Contains no peat having ash content less than 25 percent by dry weight
Dry and intermittently dry area underlain by sand, supporting pine-palmetto and savannah vegetation
Site where humus was probed with a peat auger
Drill hole
Auger hole
Roadless area boundary, approximately located
Altitude, in feet
Black Creek Islands
Forest Service Road 100
Forest Service Road 119-4
Black Creek
0 1 MILE
0 1 KILOMETERS
Planimetric base adapted from U.S. Geological Survey, 1:24,000 Sumatra and Wilma, 1946
Humus mapped by Cornelia C. Cameron

Figure 4. The Black Creek Islands Roadless Area, Apalachicola National Forest, Florida.

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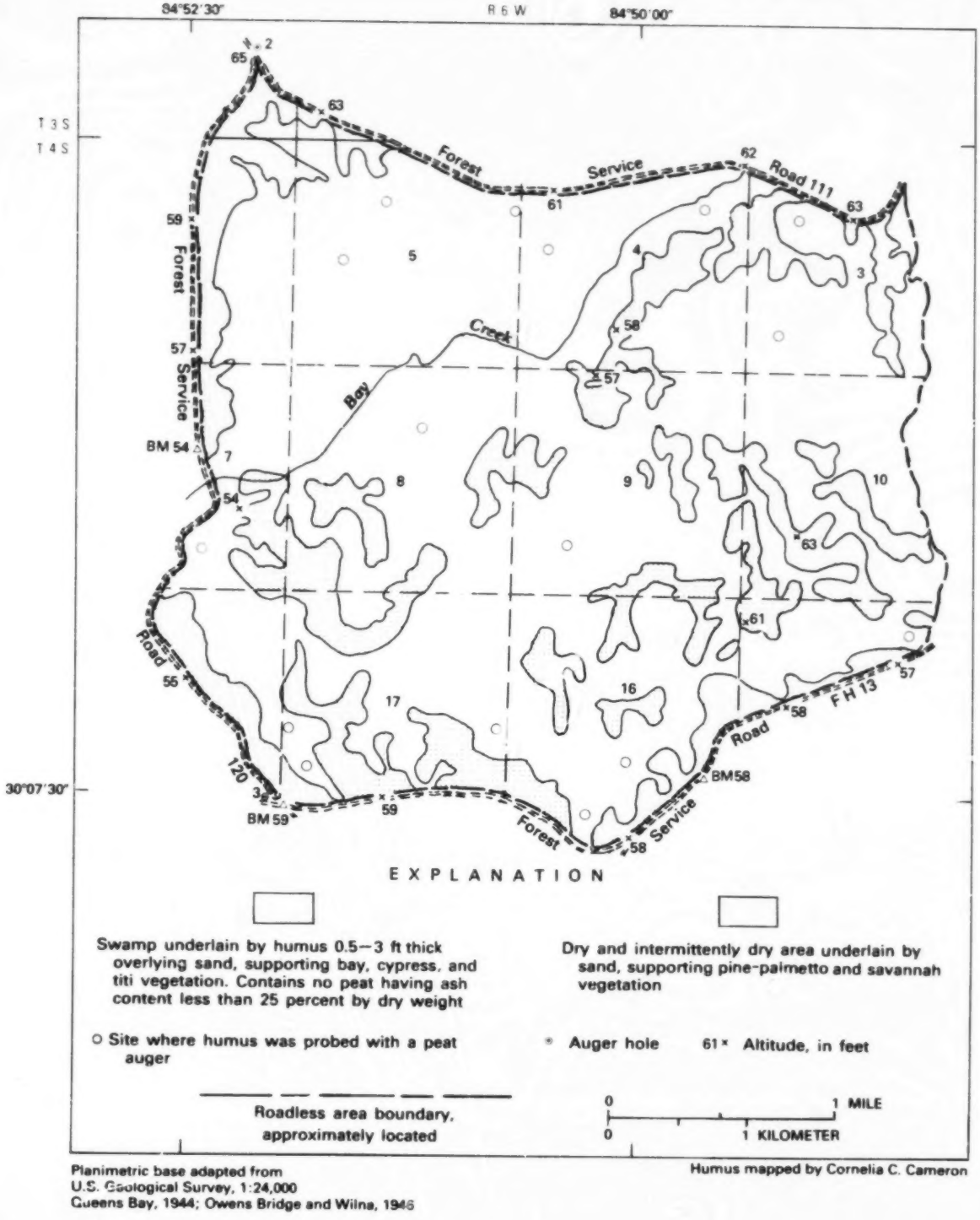

Figure 5. The Bay Creek Roadless Area, Apalachicola National Forest, Florida.

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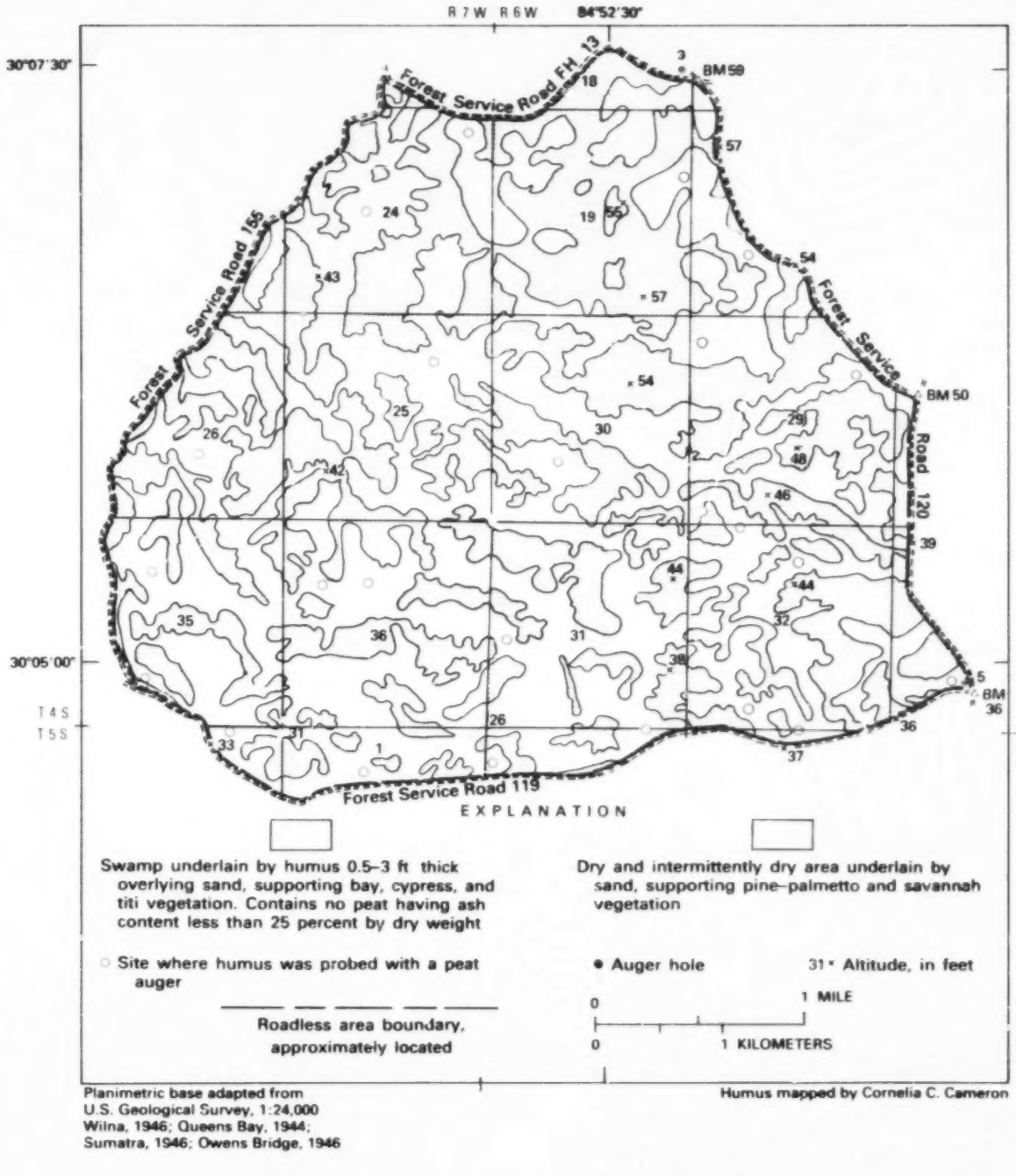
R 7 W R 6 W
84°52'30"
30°07'30"
30°05'00"
T 4 S
T 5 S
Forest Service Road FH 13
Forest Service Road 155
Forest Service Road 120
Forest Service Road 119
BM 59
BM 50
BM 36
EXPLANATION
Swamp underlain by humus 0.5–3 ft thick overlying sand, supporting bay, cypress, and titi vegetation. Contains no peat having ash content less than 25 percent by dry weight
Dry and intermittently dry area underlain by sand, supporting pine–palmetto and savannah vegetation
Site where humus was probed with a peat auger
Auger hole
31 • Altitude, in feet
Roadless area boundary, approximately located
0 1 MILE
0 1 KILOMETERS
Planimetric base adapted from U.S. Geological Survey, 1:24,000 Wilna, 1946; Queens Bay, 1944; Sumatra, 1946; Owens Bridge, 1946
Humus mapped by Cornelia C. Cameron

Figure 6. The Providence Roadless Area, Apalachicola National Forest, Florida.

(1964, pl. 1). Schmidt and Clark (1980) presented the results of a thorough study of the geology of Bay County, Fla., which is about 25 mi west of the Seven Roadless Areas, and Hendry and Sproul (1966) outlined in the geology of Leon County to the northeast of the Areas. Some information on the stratigraphy of the region is contained in publications covering the entire State by Puri and Vernon (1964) and Chen (1965). A report by Applegate, Pontigo, and Rooke (1978) summarized information on the oil and gas potential of the Big Bend region.

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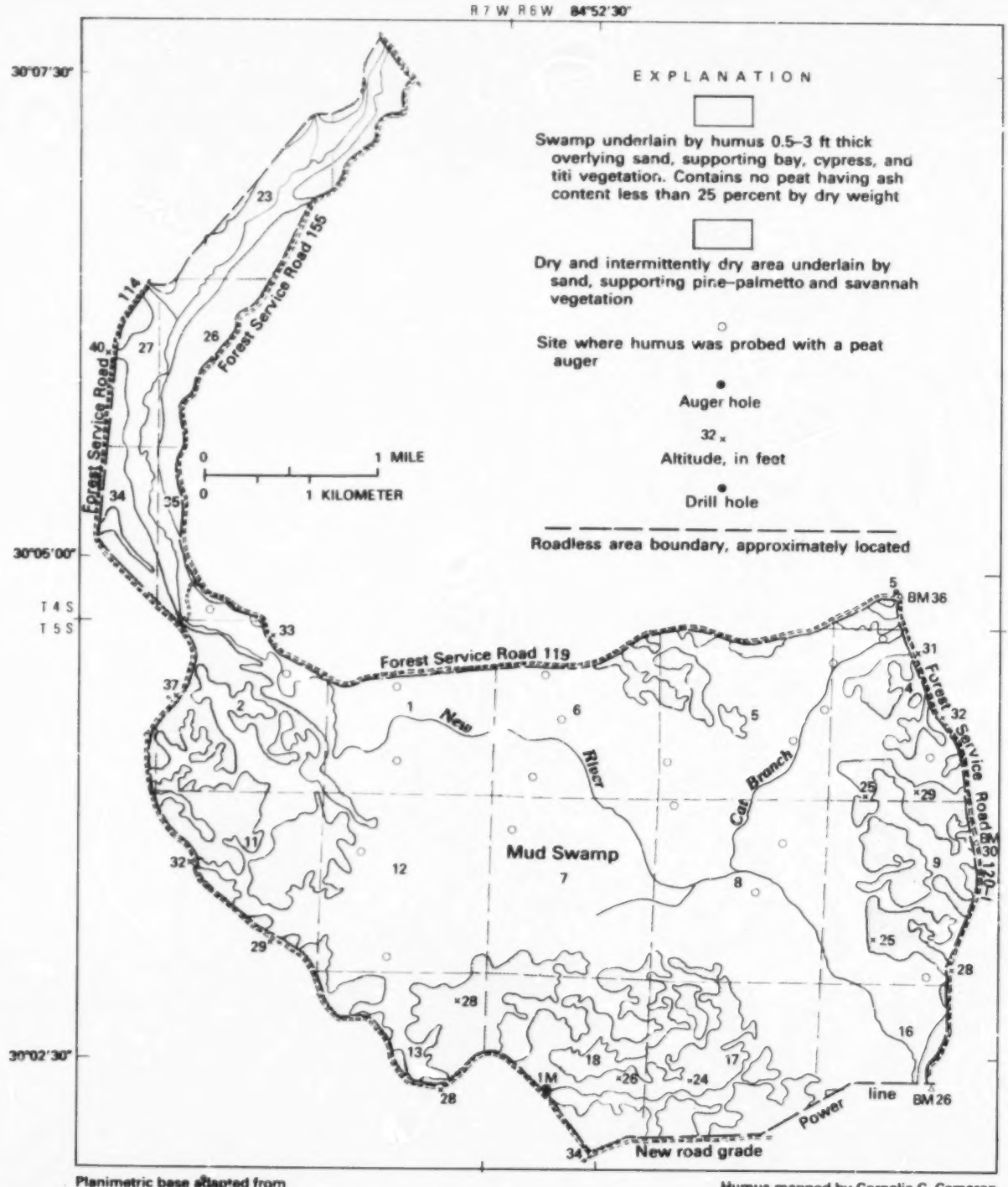
R 7 W R 6 W 84°52'30"
30°07'30"
30°05'00"
30°02'30"
T 4 S
T 5 S
EXPLANATION
Swamp underlain by humus 0.5–3 ft thick overlying sand, supporting bay, cypress, and titi vegetation. Contains no peat having ash content less than 25 percent by dry weight
Dry and intermittently dry area underlain by sand, supporting pine–palmetto and savannah vegetation
Site where humus was probed with a peat auger
Auger hole
32
Altitude, in feet
Drill hole
Roadless area boundary, approximately located
0 1 MILE
0 1 KILOMETER
Forest Service Road 155
Forest Service Road 114
Forest Service Road 119
Forest Service Road 120
New River
Cat Branch
Mud Swamp
BM 36
BM 30
BM 26
Power line
New road grade
Planimetric base adapted from U.S. Geological Survey, 1:24,000 Owens Bridge, 1946; Sumatra, 1946; Wilna, 1946
Humus mapped by Cornelia C. Cameron

Figure 7. The Mud Swamp–New River Roadless Area, Apalachicola National Forest, Florida.

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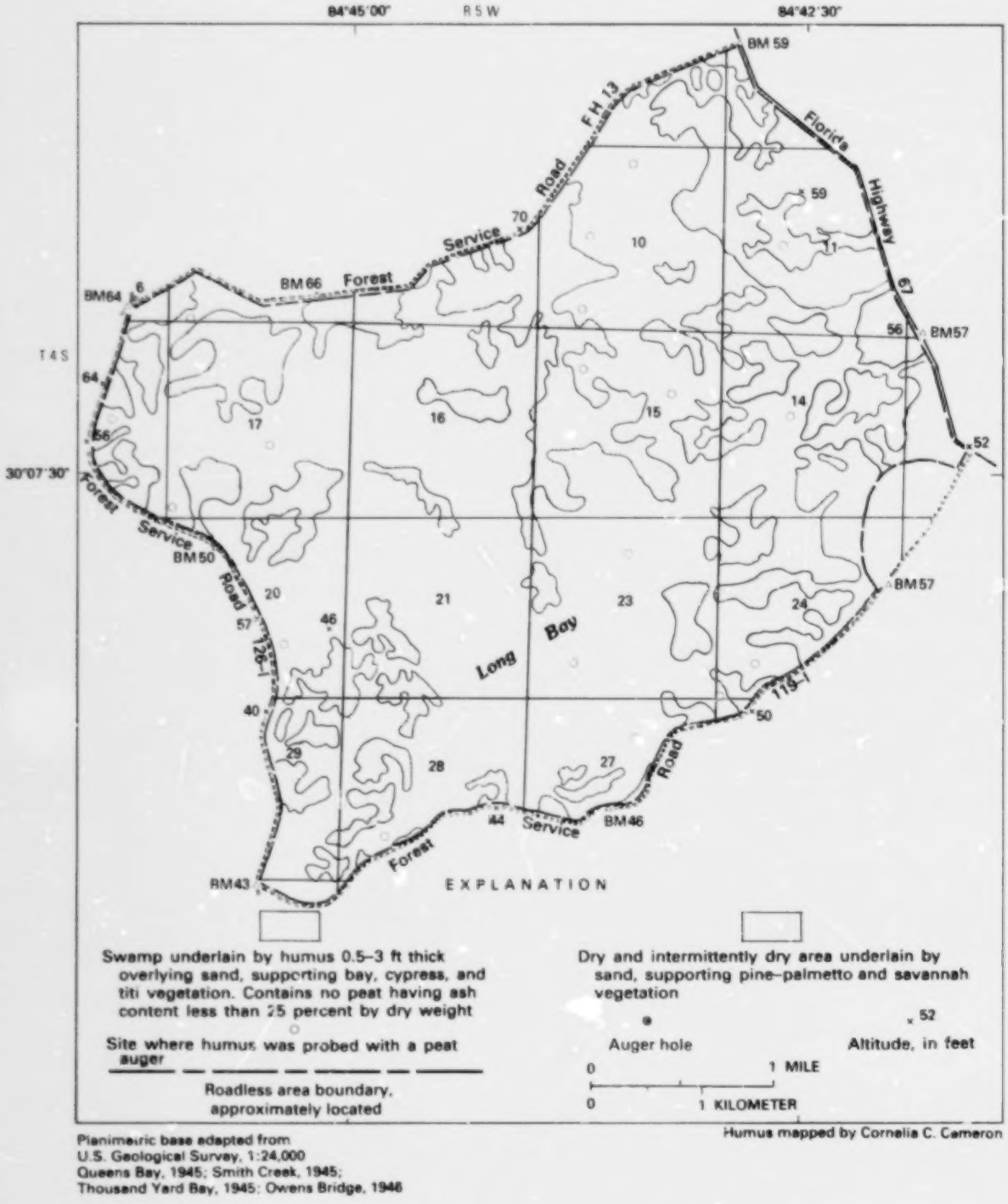

Figure 8. The Long Bay Roadless Area, Apalachicola National Forest, Florida.

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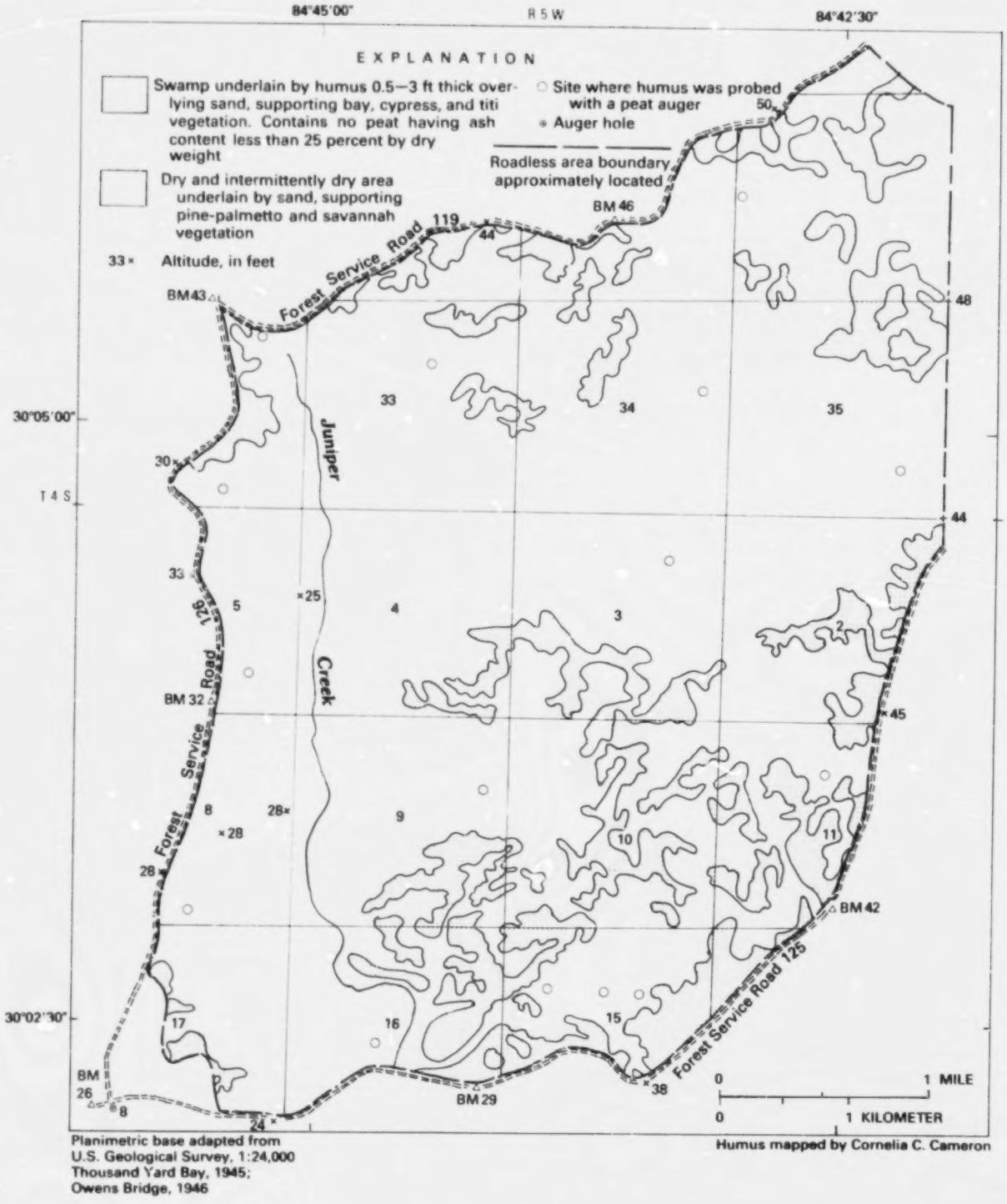
84°45'00"
R 5 W
84°42'30"
EXPLANATION
Swamp underlain by humus 0.5—3 ft thick overlying sand, supporting bay, cypress, and titi vegetation. Contains no peat having ash content less than 25 percent by dry weight
Dry and intermittently dry area underlain by sand, supporting pine-palmetto and savannah vegetation
33 × Altitude, in feet
Site where humus was probed with a peat auger
Auger hole
Roadless area boundary approximately located
Forest Service Road 119
Forest Service Road 125
Juniper Creek
BM 46
BM 43
BM 32
BM 42
BM 29
BM 26
30°05'00"
30°02'30"
T 4 S
1 MILE
1 KILOMETER
Planimetric base adapted from U.S. Geological Survey, 1:24,000 Thousand Yard Bay, 1945; Owens Bridge, 1946
Humus mapped by Cornelia C. Cameron

Figure 9. The Gum Bay Roadless Area, Apalachicola National Forest, Florida.

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Present Investigation

C. C. Cameron and Paul Schruben made surficial geologic maps of the Seven Roadless Areas (figs. 3–9) from field observations in December 1980 and December 1983 and unpublished soils maps prepared by James Hart (written commun., 1980). Cameron and Schruben's field work included probing peaty material at localities shown on figures 3–9 with a Davis peat sampler, which is a tubular piston device. S. H. Patterson reviewed the literature on the geology of the Apalachicola National Forest, reconnoitered the region, searched reports and records of the Florida Bureau of Geology for information on oil and gas in spring 1980, and worked on the drilling program in 1980 and the augering, which was completed in 1983.

In a joint program of the USGS and the USBM, one hole was drilled in the Savannah Roadless Area and one in the Mud Swamp–New River Roadless Area (fig. 7, hole 1M) in October 1980. Cores and cuttings were logged at the drill hole sites and samples were collected and later investigated in the laboratory. Walter Schmidt supervised the drilling program of the Florida Bureau of Geology and correlated the rocks penetrated, providing much of the information discussed in the text and on which figure 10 is based. Schmidt also participated with Patterson in the augering of nine holes (fig. 10) in December 1983.

The information on dry holes given in this report is based primarily on published reports and records on file with the Florida Bureau of Geology. The term "dry hole" is used according to the definition meaning no significant amounts of oil or gas were found.

No geochemical survey was necessary during the work leading to this report because stream-sediment and soil sampling would have yielded no information of value in appraising the nonmetallic mineral potential of the Seven Roadless Areas. The metallic and other heavy minerals occurring in strata near the surface are not in sufficient concentrations to form valuable mineral deposits.

ACKNOWLEDGMENTS

The authors are grateful for the cooperation of the Florida Bureau of Geology and the U.S. Forest Service. David Curry and Felipe A. Pontigo, Jr., of the Florida Bureau of Geology aided in gathering information on oil and gas. Tim Smith and Larry Thornton of the Apalachicola Ranger District, Apalachicola National Forest, provided maps and storage facilities for drilling equipment and samples. U.S. Forest Service personnel—William R. Waite, soil scientist, Forest Supervisors Office, Tallahassee, Fla., James Hart, soil scientist, Wakulla Ranger District, Crawfordville, Fla., and Edward W. Read, geologist, Region 8 Office, Atlanta, Ga.—provided soils and boundary maps and other information during the investigation. The USBM cooperated in the drilling program.

GEOLOGY

The Seven Roadless Areas are blanketed entirely by a veneer of unconsolidated sediments that overlie a thick sequence of sedimentary rocks deposited in the Apalachicola embayment. The "A" horizon soil covering the dry parts of the Seven Roadless Areas is rarely more than a foot thick. It consists chiefly of slightly clayey sand containing minor amounts of organic matter and root remains. Surficial soil and swamp deposits are underlain by a blanket of Pleistocene and Holocene unconsolidated sand, gravel, and clay that is 15 ft or more in thickness. The underlying Pliocene Jackson Bluff Formation, which is the uppermost bedrock unit, also extends over the entire area. It, in turn, is underlain by a thick sequence of older rocks described in the following sections.

Stratigraphy

Igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Cenozoic (table 2) are almost certainly present at depth in the Seven Roadless Areas. A well drilled offshore about 30 mi southeast of the Seven Roadless Areas intersected 10 ft of diabase at a depth of 10,460 ft (Milton, 1972, p. 31). This diabase is overlain by pinkish quartzitic sandstone and underlain by diabase fragments admixed with sandstone. Sills or dikes or mafic igneous rock have been found in Triassic sedimentary rocks penetrated by a few dry holes in the region (Applegate, Pontigo, and Rooke, 1978, p. 81). One dry hole, 25 mi southwest of the Seven Roadless Areas, passed into an arkose (F. A. Pontigo, oral commun., 1981). Another dry hole, about 25 mi northwest of the Seven Roadless Areas, penetrated quartzite and metamorphosed shale of probable Paleozoic age. A Hunt Oil Co. dry hole, about 30 mi west-northwest of the Seven Roadless Areas, penetrated a Precambrian granite (F. A. Pontigo, oral commun., 1981).

Mesozoic Era

Mesozoic strata in the Apalachicola embayment have a total thickness of about 10,000 ft. They generally extend from 3,000 to about 13,000 ft below sea level and include rocks of Triassic, Jurassic, and Cretaceous age.

Triassic rocks consist of indurated micaceous sandstone and shale that are commonly red. Triassic beds exceed 1,950 ft in thickness in southeastern Leon County, about 40 mi east-northeast of the Seven Roadless Areas.

Five major stratigraphic units of Jurassic age occur in the region of the Seven Roadless Areas. The lowermost, the Louann Salt, is distributed irregularly and consists of salt with minor impurities. One dry hole, located 4 mi north of the Seven Roadless Areas, bottomed in salt after penetrating 34 ft (Applegate, Pontigo, and Rooke, 1978, p. 82), but the

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Table 2. Generalized stratigraphic section in the region of the Apalachicola National Forest[1]

ERA	PERIOD	EPOCH	ROCK UNITS OR FORMATIONS AND DESCRIPTIONS		APPROXIMATE DEPTH IN FEET BELOW SURFACE (NOT TO SCALE)
CENOZOIC	QUATERNARY	HOLOCENE	Undifferentiated quartz sand		
		PLEISTOCENE	Undifferentiated clay, sand, and gravel		
	NEOGENE	PLIOCENE	JACKSON BLUFF FORMATION	Gray-olive-green, clayey, sandy, shell marl	100
			INTRACOASTAL FORMATION (Schmidt and Clark, 1980)	Gray-olive-green, sandy, argillaceous, poorly consolidated, very microfossiliferous calcarenite	
		MIOCENE UPPER	UNNAMED DOLOSILTSTONE	Unconsolidated silt-sized dolomite crystals	300
		MIOCENE MIDDLE	BRUCE CREEK LIMESTONE (Huddlestun, 1976)	White to light-yellow, moderately indurated, granular limestone	400
			CHIPOLA FORMATION	Sandy, very light orange, fossiliferous limestone	
		MIOCENE LOWER	ST. MARKS FORMATION	Sandy, micritic, white to light-gray limestone	500
	PALEOGENE	OLIGOCENE	SUWANNEE LIMESTONE	Light-gray to yellow-gray, dolomitic limestone, often highly altered, sucrosic, altered fossil types	
			MARIANNA LIMESTONE	Light-gray, massive, chalky, glauconitic, slightly sandy limestone, abundant large foraminifera	
		EOCENE UPPER	OCALA LIMESTONE	Light-orange to white, high-porosity limestone, small amounts of sand and chert; glauconite in lower facies abundant microfossils	700
		EOCENE MIDDLE	LISBON FORMATION	Lightest gray, glauconitic, sandy limestone; light-gray clay; soft pyritic limestone; gray, calcareous, glauconitic sand	
			TALAHATTA FORMATION	Lightest gray, glauconitic sandy, clayey limestone and gray, sandy, calcareous clay	1,000
		EOCENE LOWER	WILCOX FORMATION (Chen, 1965)	Sandy lightest gray, glauconitic limestone; calcareous sand; gray, pasty limestone; micaceous clay	
		PALEOCENE	MIDWAY FORMATION (Chen, 1965)	Gray, micaceous, sandy clay; with seams of sandy, soft limestone	
MESOZOIC	CRETACEOUS	UPPER	SELMA GROUP	Marl, calcareous clay, and limestone; interbedded sand, glauconitic, micaceous	3,000
			EUTAW FORMATION	Calcareous sandstone, sandy chalk	
			TUSCALOOSA FORMATION	Marine and nonmarine sand and shale	
		LOWER	UNDIFFERENTIATED	Reddish-brown shale and sandstone	
	JURASSIC		COTTON VALLEY GROUP	Varicolored mudstone and sandstone	7,000
			HAYNESVILLE FORMATION	Red-gray, calcareous shale, sandstone, micrite	
			SMACKOVER FORMATION	Limestone, dolomitic limestone	
			NORPHLET FORMATION	Red sandstone, siltstone, and shale	
			LOUANN SALT	Salt with minor impurities	
	TRIASSIC		EAGLE MILLS FORMATION	Micaceous sandstone; argillaceous siltstone; well-indurated shale; often contains sills and dikes of igneous rocks	10,000
PALEOZOIC	CAMBRIAN		Quartzite and metaarkose		11,000
PRECAMBRIAN			GRANITE	"Basement"?	13,000

[1]Modified from Schmidt and Clark (1980, fig. 16).

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formation is known to be much thicker farther east. The overlying Norphlet Formation is mainly red sandstone, siltstone, and shale that has a total thickness ranging from 0 to 300 ft. The third unit, the Smackover Formation, consists of limestone, dolomitic limestone, siltstone, and sandstone. The Smackover was found to be 186 ft thick where penetrated by a dry hole located 6 mi south of Mud Swamp–New River Roadless Area, and this formation extends northward (Applegate, Pontigo, and Rooke, 1978, fig. 1) under all the Seven Roadless Areas except the Long Bay and Gum Bay Areas. The fourth Jurassic unit, the Haynesville Formation, is present locally above the Smackover and consists of red siltstone, shale, and sandstone. The uppermost Jurassic Unit, the Cotton Valley Group undifferentiated, is a sequence of varicolored mudstone and coarse sandstone and has a total thickness of as much as 2,600 ft.

Lower and Upper Cretaceous rocks occur in the Apalachicola embayment. The Lower Cretaceous rocks consist of an undifferentiated sequence of sandstone and shale and have a total thickness of 5,000–6,000 ft (Schmidt and Clark, 1980, p. 28). The overlying Upper Cretaceous Tuscaloosa Formation is made up of the following three members: A lower nonmarine sand and variegated shale member, a middle member of glauconitic hard shale, and an upper member of calcareous sandstone. The Tuscaloosa is variable in thickness but locally is more than 700 ft thick. The Eutaw Formation, above the Tuscaloosa, consists of gray to light-gray sandstone that changes downdip to soft, pasty, sandy chalk. The beds above the Eutaw consist of undifferentiated marls, calcareous clays, and limestones interbedded with glauconitic, micaceous sands that make up the Selma Group (table 2). The total thickness of the Upper Cretaceous beds is 1,800–2,000 ft.

Cenozoic Era

Paleocene beds in the Florida Panhandle rest unconformably on the Cretaceous formations and are assigned to the Midway Formation (Chen, 1965, p. 44–47, figs. 21–24, 26, 41). Chen's (1965) figure 24 shows the Midway to be 300–400 ft thick in the vicinity of the Apalachicola National Forest. The lithology of the Midway below the Seven Roadless Areas is probably similar to that in Bay County to the southwest where it was described by Schmidt and Clark (1980, fig. 16) as listed in table 2.

The lower Eocene is represented in the region of the Apalachicola National Forest by a sequence of glauconitic, calcareous sandstone and greenish-gray, micaceous, calcareous, glauconitic, silty shale that Chen (1965, p. 53–54, fig. 30) assigned to the Wilcox Formation. According to Chen's figure 30, the Wilcox Formation is approximately 700 ft thick in the region of the Seven Roadless Areas.

Middle Eocene strata underlying the Apalachicola National Forest are probably similar to those in Bay County to the southwest where Schmidt and Clark (1980, p. 31) have recognized the Tallahatta and Lisbon Formations. The Tallahatta, the lower of the two formations, is composed of light-gray, glauconitic, sandy, clayey limestone and gray, sandy, calcareous clay. The Lisbon is similar to the Tallahatta, but it contains light-gray clay, soft pyritic limestone, and glauconitic sand. The combined thickness of the two middle Eocene formations is about 800 ft.

The upper Eocene Ocala Limestone consists of limestone beds containing large foraminifers and a few megafossils. The Ocala underlying the Seven Roadless Areas is probably about 300 ft thick.

Oligocene strata in the region of the Seven Roadless Areas are assigned to two formations. The lower unnamed formation is a light-gray chalky limestone that possibly correlates with the Marianna Limestone exposed in Jackson County about 40 mi northwest of the Seven Roadless Areas. The upper formation, the Suwannee Limestone, is generally a buff, dolomitic limestone, but, locally, it is chiefly dolomite. The combined thickness of the two Oligocene formations is 175–200 ft.

Several Miocene carbonate formations occur in the region of the Apalachicola National Forest. The lower Miocene St. Marks Formation probably underlies some of the Seven Roadless Areas, but it is known to be missing in parts of the region. Its absence is likely due to erosion before the deposition of younger beds. Where present, the St. Marks is sandy, micritic, white to light-gray limestone. In places, the St. Marks is as much as 100 ft thick.

The middle Miocene strata in the region of the Seven Roadless Areas are classified in three stratigraphic units and the lower part of the Intracoastal Formation (Schmidt and Clark, 1980). The lower unit, the Chipola Formation, like the St. Marks Formation, is distributed irregularly and is likely to be missing in the subsurface of the Seven Roadless Areas. Where present, the Chipola typically consists of very light orange limestone containing clear crystal, finely crystalline, and pellet grains of carbonate. Foraminifers, corals, and mollusks are commonly present. The Chipola is generally about 50 ft thick. The third unit is the Bruce Creek Limestone of Huddlestun (1976) as described by Schmidt and Clark (1980, p. 38–40). Bruce Creek beds penetrated by drill holes F1 and F2 (fig. 10*A*) consist of light-gray indurated limestone containing pellets, mollusks, foraminifers, echinoids, and bryozoa fossils. Beds penetrated by drill hole F3 (figs. 10*A*, *B*) were more dolomitic than the limestone found in the core from holes F1 and F2 (figs. 10*A*, *B*). Drill holes F1–3 passed through algal beds in the upper part of the Bruce Creek Limestone. The Bruce Creek is overlain by an unnamed stratum of dolostone. This dolostone is claylike in appearance, but, when examined with a microscope, it was found to consist of uncemeneted dolomite rhombohedra. The dolosiltstone is 5–20 ft thick.

The uppermost middle Miocene and the upper Miocene beds in the region of the Apalachicola National Forest form the lower and middle parts of the Intracoastal

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Formation; the upper part of this formation is thought to be Pliocene. The Intracoastal Formation, as used by Schmidt and Clark (1980), was penetrated by drill holes F1–4 (fig. 10). It consists mainly of fine to very coarse sand-sized foraminifers and shell and echinoid fragments and also contains minor amounts of calcareous clay, quartz sand, phosphate pellets, glauconite, and miscellaneous heavy minerals.

The upper Pliocene Jackson Bluff Formation, which overlies the Intracoastal Formation, consists mainly of unconsolidated light-gray, coarse sand- to gravel-sized mollusk fragments, forming a shell hash, and some clay. A dark-gray, very sandy clay as much as 4 ft thick occurs locally in the upper part of the Jackson Bluff Formation. The shell hash contains minor amounts of quartz sand and traces of phosphate pellets, glauconite, and miscellaneous heavy minerals.

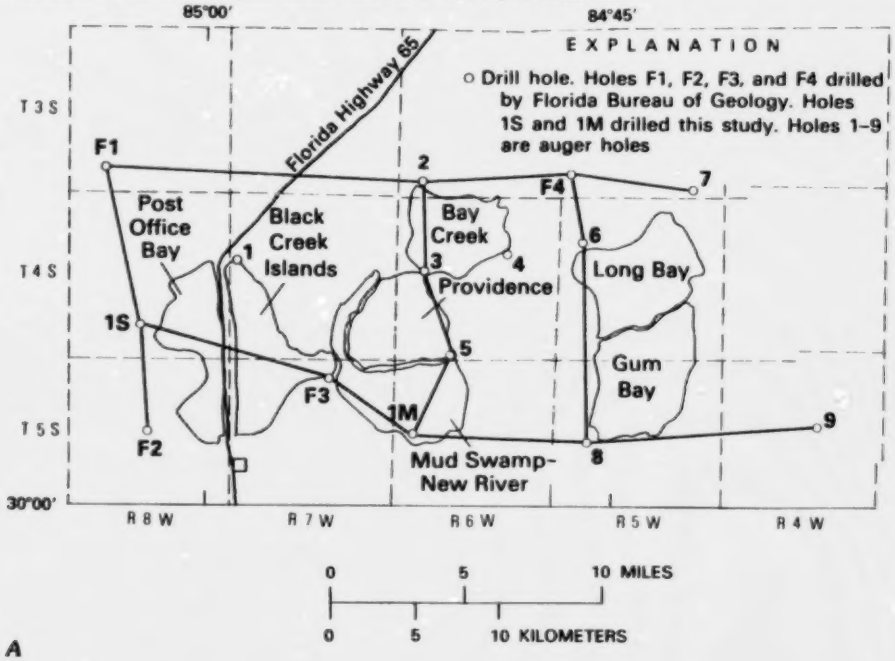
As much as 100 ft of unconsolidated clastic sediments and surficial soil and peaty material blanket the region of the Seven Roadless Areas. The clastic sediments contain variable minor amounts of heavy minerals and traces of phosphate pellets. The clastic sediments are thought to be chiefly Pleistocene in age; however, some of the lower beds may be as old as Pliocene. The oil and peaty material as well as the uppermost clastic beds are probably Holocene in age. The lower part of the clastic sediments is chiefly light-gray, medium to fine quartz sand. The middle part of the clastic sediments in the Post Office, Black Creek Islands, Bay Creek, Providence, and Mud Swamp–New River Roadless Areas consists of as much as 40 percent angular to subangular, very coarse quartz sand and gravel, and the remainder is fine to medium sand. The upper clastic sediments are chiefly yellow and brown, fine to medium quartz sand containing minor amounts of clay. The "A" horizon soil in the higher parts of the forest is generally less than a foot in thickness. This horizon is chiefly sand and contains minor amounts of clay and organic materials. Peaty material occurs in swamps scattered throughout the Seven Roadless Areas.

Structure

The Seven Roadless Areas are located in the central part of the Apalachicola embayment, a deep structural basin that was formed by the depression of crustal rocks. The embayment was filled with Triassic to Quaternary sediments having a total thickness of more than 14,000 ft. Deep rocks along the axis of the embayment plunge about 65 feet per mile to the west-southwest (Applegate, Pontigo, and Rooke, 1978, p. 80). Shallow rocks, which were deposited after the embayment was almost filled, dip only a few feet per mile toward the Gulf of Mexico.

No faults have been recognized in the Seven Roadless Areas. However, minor disturbances of strata caused by

Figure 10. Location of drill and auger holes and geologic sections in and near the Seven Roadless Areas in the Apalachicola National Forest, Florida.



A

Figure 10A. Locations.

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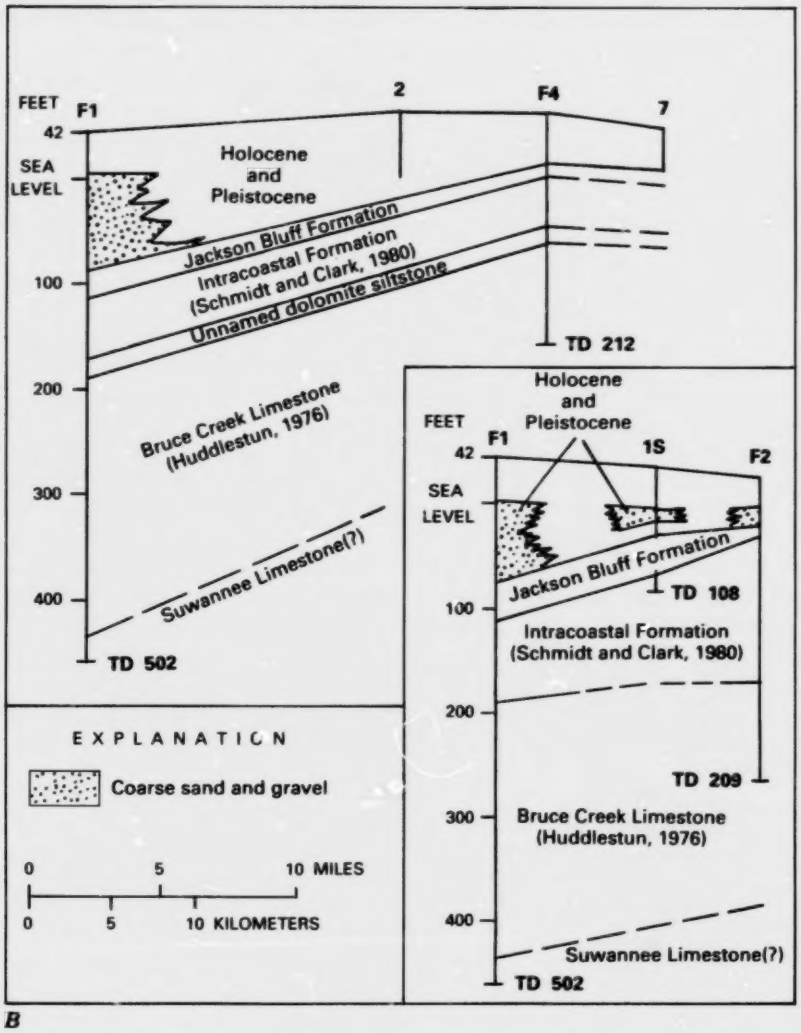
Figure 10. Location of drill and auger holes and geologic sections in and near the Seven Roadless Areas in the Apalachicola National Forest, Florida — Continued



B

Figure 10*B*. Geologic sections F1–7 and F1–2 near the Seven Roadless Areas, Apalachicola National Forest, Florida.

slumping into solution cavities no doubt have occurred in a few places. Rock displacements of this type involve breakage and differential movement but ordinarily are not considered to be structural features.

ASSESSMENT OF MINERAL-RESOURCE POTENTIAL

Fuller's earth, common clay, sand and gravel, and clayey sand are produced in the Big Bend region, and limestone was quarried and peat dug in the past. The region also has been explored for phosphate and reconnoitered for heavy minerals, but no commercial deposits have been found. No mining activity has occurred within the Seven Roadless Areas, and the only production nearby has been the digging of clayey sand used in stabilizing Forest Service roads and highway construction.

Fuller's Earth and Other Clays

A large district leading the world in the production of palygorskite (attapulgite)-type fuller's earth straddles the boundary of Florida and Georgia northeast of the Seven Roadless Areas (Patterson, 1974). The closest active processing plant is at Quincy, Fla., about 40 mi north-northeast of the Seven Roadless Areas.

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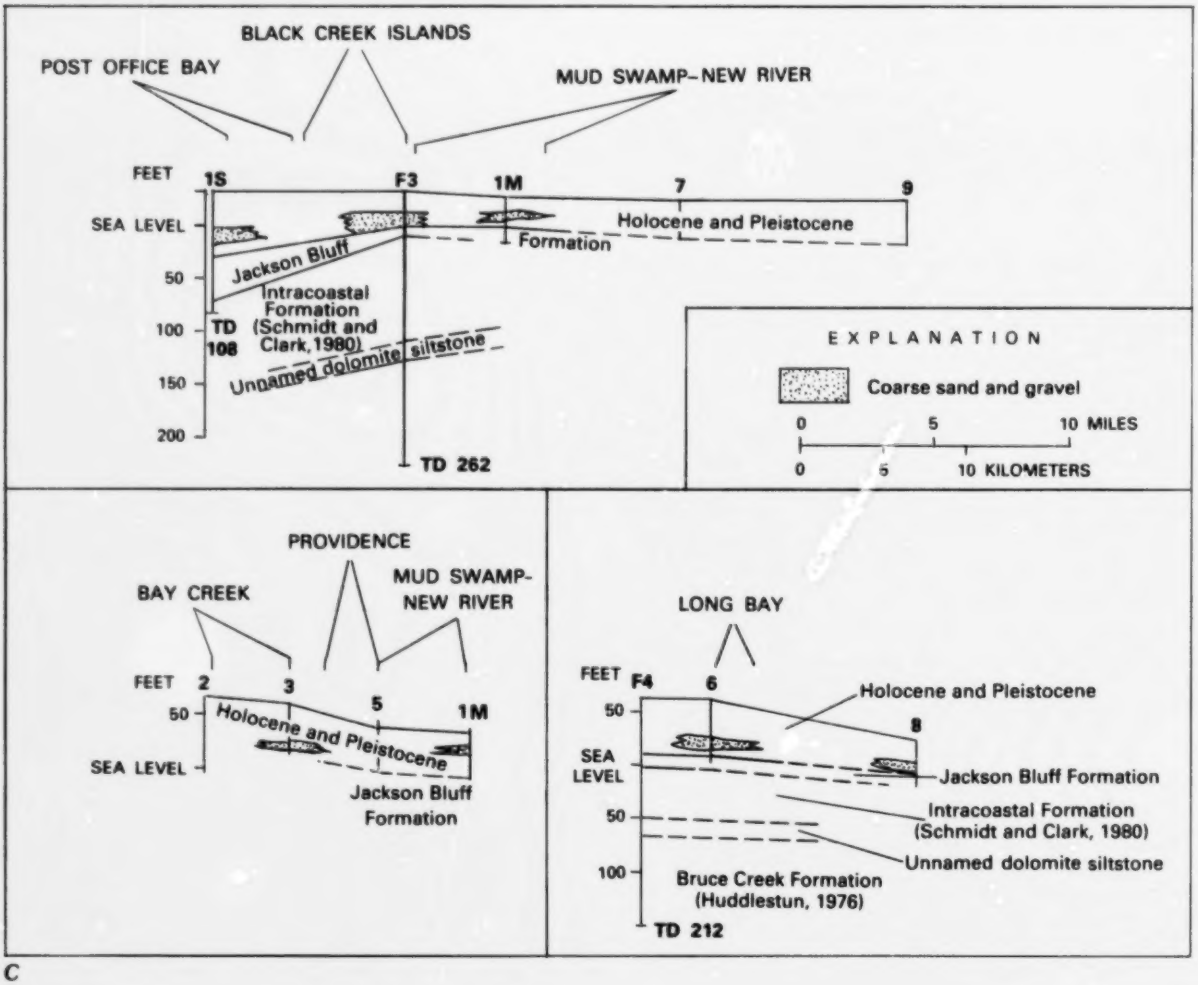
Figure 10. Location of drill and auger holes and geologic sections in and near the Seven Roadless Areas in the Apalachicola National Forest, Florida — Continued



C

Figure 10C. Geologic sections 1S–9, 2–1M, and F4–8 in and near the Seven Roadless Areas, Apalachicola National Forest, Florida.

The fuller's earth occurs in the Miocene Hawthorn Formation, which is not present in the Roadless Area, and no fuller's earth was found in the core from five drill holes; therefore, we conclude the Seven Roadless Areas have no potential for fuller's earth.

The only current mining of common clay in the Big Bend region is at the Apalachee Correctional Institution plant south of Chattahoochee (fig. 11). This plant, which is operated by the State of Florida, uses clayey and silty alluvium from the flood plain of the Apalachicola River to make common construction brick.

Very sandy plastic clay was penetrated by the drill hole in the Mud Swamp–New River Roadless Area (fig. 10, hole 1M) at a depth interval of 23–29.5 ft, but it has little value for use in brickmaking. The clay minerals in this clay are chiefly kaolinite and minor smectite (montmorillonite). In addition to being very sandy, it contains shell fragments that are undesirable in raw materials used for brick. Whereas the alluvium used at the Apalachee Correctional Institution plant is at the surface, this clay is under overburden that would have to be removed if it were to be used. The clay in the Seven Roadless Areas is also at excessive distances from markets. No other deposits of common clay are known to be present in the Roadless Areas.

Heavy Minerals

Several reconnaissance studies of the heavy minerals in sands in the Big Bend region have been made, but no valuable concentrations have been found. The studies in-

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clude M.S. theses on heavy minerals in Leon and Wakulla Counties (cited by Schmidt and Clark, 1980, p. 72). In the work leading to the present report (table 2), heavy-mineral determinations made were those of samples from the depth intervals 3–15 ft containing 0.4 percent and 15–20 ft containing 0.14 percent in the drill hole 1M (fig. 7). These concentrations are far too low for profitable recovery, inasmuch as heavy-mineral deposits being mined in Florida contain an average of 4 percent heavy minerals (Garner, 1981, p. 30). Heavy minerals identified in samples from the Apalachicola National Forest include biotite, muscovite, ilmenite, tourmaline, staurolite, sillimanite, rutile, leucoxene, kyanite, chlorite, garnet, and phosphate. The wide range of mineral species present, rather than concentrations of such valuable minerals as ilmenite, rutile, and zircon, further detracts from the heavy-mineral potential of the sand.

Limestone

Several inactive quarries, where limestone was obtained for stabilizing secondary roads, are scattered throughout the Big Bend region. The largest one is in sec. 4, T. 3 S., R. 1 W., which is about 20 mi east-northeast of the Long Bay Area, the easternmost of the Seven Roadless Areas. The workings of this quarry, which has not been operated for many years, extend over more than 40 acres. Another old quarry is located in sec. 12, T. 4 S., R. 2 W., 2.3 mi south of Crawfordville (fig. 11). The limestone in both quarries is in the lower Miocene St. Marks Formation. Marl, a soft impure calcareous rock, also was dug for road-surfacing material in western Leon County and east-central Franklin County.

Very large quantities of limestone are present below the surface of the Seven Roadless Areas, but they have no economic value. The limestone is under excessive thickness of overburden, whereas virtually unlimited quantities at sites in other parts of the Big Bend region are more favorable for quarrying and closer to markets.

Peat

Peat is a naturally occurring accumulation of plant remains in swamps and marshes. The term "peat," as defined by the American Society for Testing Materials (1969), is applied to organic material having an ash content not exceeding 25 percent on a dry basis; to have resource potential for horticultural use, it must have a thickness of 5 ft or more over an area of no less than 80 acres or 4 ft over several hundred acres; for use as fuel peat, it must be at least 5 ft thick over large areas. Organic deposits containing more than 25 percent ash are referred to as peaty material.

The peat production closest to the Seven Roadless Areas has been near Carabelle, about 15 mi southeast of the Areas, where both bulk and packaged peat have been prepared (Cameron and Mory, 1977, p. 29).

Although no deposits of peat occur in the Seven Roadless Areas, thin accumulations of humus peaty material (containing more than 25 percent ash) occur in all of the Seven Roadless Areas (figs. 3–9). Most of the high-ash humus peaty material is in swamps supporting a cypress-black gum with cedar flora. These swamps typically have layers of humus 2–3 ft thick. Thicknesses of peaty material in swamps having titi with cypress type of vegetation range from 0 to about 1 ft. The humus peaty deposits in the Seven Roadless Areas are too thin and too impure to be considered mineral resources.

Phosphate

Very minor amounts of phosphate are present in the Pleistocene to Holocene sand, the Pliocene Jackson Bluff Formation, and the "Intracoastal Formation" (Schmidt and Clark, 1980) underlying the Apalachicola National Forest. The phosphate occurs as scattered black, gray, tan, and white pellets of very fine to medium-grain size and rarely as fossil remains. Some of the phosphatic materials are thought to have been reworked from deposits in the Miocene Hawthorn Formation farther north.

Although minor amounts of phosphate are present in the strata underlying the Seven Roadless Areas, very little possibility exists that commercial deposits are present. Only trace amounts of phosphatic material were found in samples from the drill core from hole 1M, and, therefore, no tests for phosphate evaluation were made. Because of the very small amount of phosphate in the strata penetrated by hole 1M and the fact that no valuable phosphate deposits have been found in the Big Bend region, the Seven Roadless Areas are thought to have virtually no potential for commercial phosphate resources. This conclusion is supported by the results of exploration programs carried out by two companies in and near the Apalachicola National Forest in the 1960's. These two firms drilled 124 holes (some are shown in fig. 11), including several along the boundaries of the Seven Roadless Areas. One company apparently decided to do no analytical testing after examining core samples. The other company found that 37 of 52 holes penetrated phosphatic material worth sampling. The sample richest in P_2O_5 (5.45 percent) was from a 3-ft-thick interval (81- to 84-ft depth) penetrated by a single hole. Two other samples from thin, deep intervals each contained 4.16 percent P_2O_5. The remaining 49 samples contained less than 4 percent P_2O_5, and about one-half of them had less than 2 percent P_2O_5. Phosphate deposits currently being mined contain a minimum of 28 percent P_2O_5 (Cathcart, Patterson, and Crandall, 1983).

Sand

Sand for construction and miscellaneous uses is produced at several places in the Big Bend region. Sand requirements of the Tallahassee market area are satisfied by

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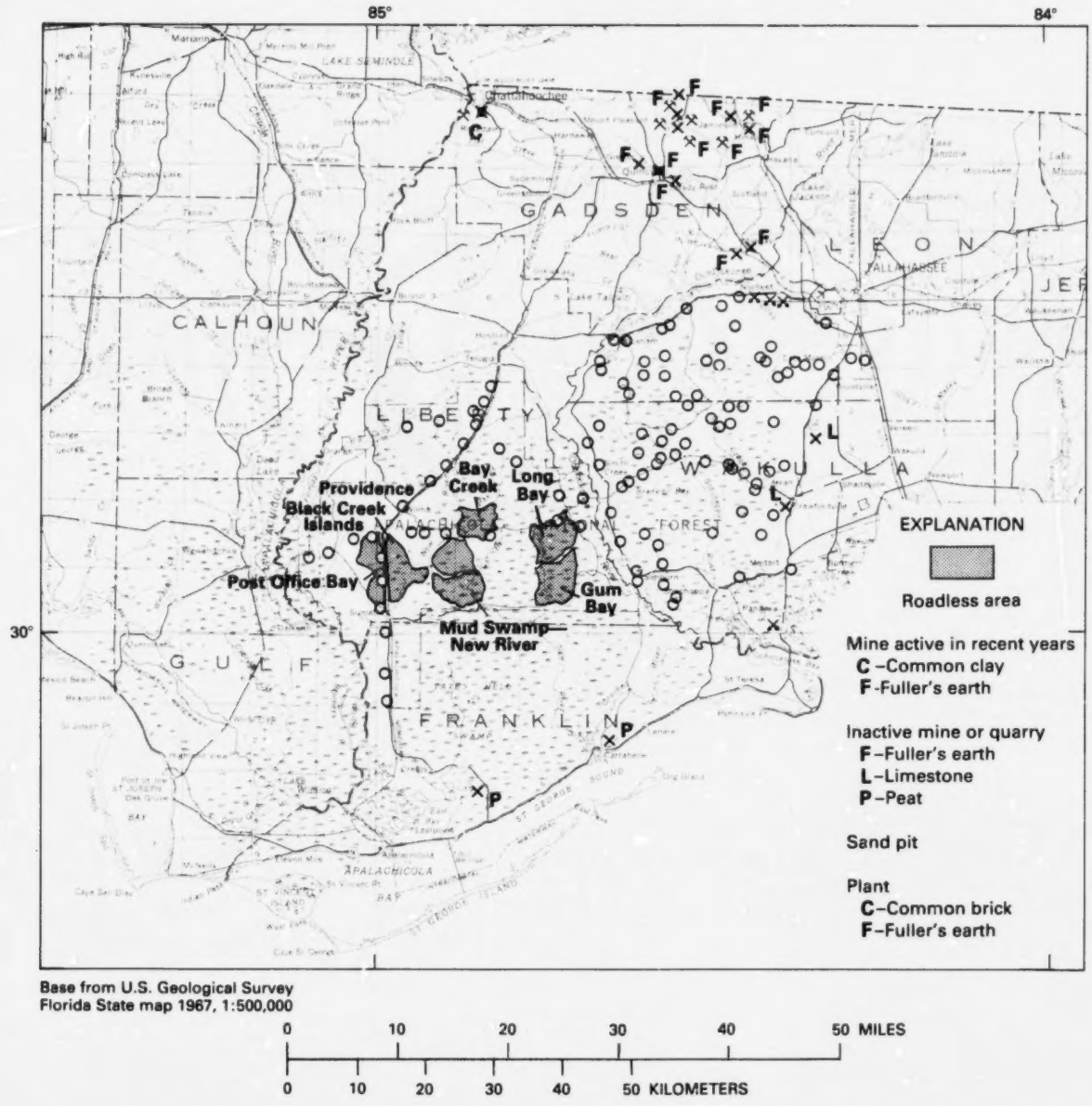

Figure 11. Locations of industrial mineral pits, mines, quarries, plants, and phosphate exploratory drill holes in the Big Bend region, Florida.

the Roberts Sand Co. at Norfleet and by two other companies operating nearby (Scott and others, 1980). A pit near Panacea, 18 mi east of the Gum Bay Roadless Area, is the source of sand for the market along the Gulf coast. Sand also is dredged from the Apalachicola River near Chattahoochee.

A sand and gravel bed 5 ft thick (depth interval 15–20 ft) was penetrated by the drill hole in the Mud Swamp–New River Roadless Areas (fig. 7, hole 1M). A sample of this bed (table 3, sample 3) was found to consist almost entirely of angular quartz, with 0.14 percent heavy minerals and 4.4 percent very fine sand, silt, and clay. Only 24 percent of this sand and gravel was finer than coarse sand, and 11.6 percent was gravel. This same sand and gravel bed was intersected by hole 1S located about 0.7 mi west of the Post Office Bay Roadless Area boundary. In addition to holes 1M and 1S, the sand and gravel stratum was intersected by drill holes F1–3 and auger holes 3, 4, 6, and 8 (fig. 10). The presence of the sand and gravel were found by drilling the widely spaced holes indicates that the deposit extends over many square miles in and near the Seven Roadless Areas. Although the sand and gravel resources in the Seven Roadless Areas would have considerable value if

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Table 3. Grain size and heavy-mineral content of sand and gravel in the region of the Seven Roadless Areas and comparative samples from the Roberts Sand Co. pit, in percent

Sample number	Gravel >10 mesh	Very coarse sand 10–18 mesh	Coarse sand 18–35 mesh	Medium sand 35–60 mesh	Fine sand 60–120 mesh	Very fine sand, silt, and clay <120 mesh	Total	Heavy minerals
1	28.6	33.2	22.0	9.8	3.4	2.8	99.8	1.8
2	0.2	5.4	27.0	31.4	15.4	20.0	99.4	.40
3	11.6	30.6	33.4	15.0	4.6	4.4	96.6	.14
4	---	.4	3.8	36.6	47.4	11.4	96.6	2.3
5	3.2	9.6	20.8	44.6	18.4	3.2	99.8	.12
6	12.2	13.2	14.6	30.8	24.2	4.6	99.6	.29

Description of samples:

1. Drill core of sand and gravel, depth interval 37–50 ft, hole 1S, Savannah Roadless Area.
2. Drill core of sand, depth interval 3–15 ft, hole 1M, Mud Swamp-New River Roadless Area.
3. Drill core of sand and gravel, depth interval 15–20 ft, hole 1M, Mud Swamp-New River Roadless Area.
4. Channel sample of clayey sand 9 ft thick in wall of borrow pit, 2 mi south of Savannah Roadless Area.
5. Composite of grab samples of upper sand beds approximately 12 ft thick in wall of Roberts Sand Co. pit, Norfleet, Fla.
6. Composite of grab samples of sand beds approximately 5 ft thick, underlying sample no. 5.

they were close to market, the remote location reduces the value. Also, the sand and gravel was found to be 13 ft thick where intersected by hole 1S, which suggests that the deposit is thicker west of the Seven Roadless Areas than within their boundaries. Furthermore, the overburden above the deposits thins southwestward from the westernmost of the Seven Roadless Areas, and sand and gravel would be less costly to produce outside of the Areas.

Clayey sand used in stabilizing Forest Service roads and highway construction is dug from several pits in the Apalachicola National Forest. Sand of this type was intersected by drill hole 1M (fig. 10*A*; table 3) at the depth interval of 3–15 ft. The presence of sand at this locality indicates that this sand which covers most of the region also is present in the Seven Roadless Areas. Although large resources of clayey sand are no doubt present, they have little value because virtually unlimited resources of this type of sand are present in the surrounding region.

ASSESSMENT OF OIL AND GAS POTENTIAL

According to the reports and records of the Florida Bureau of Geology, many exploratory wells have been drilled in search of oil and gas in the Big Bend region (fig. 12; table 4). To date, only a few shows of oil have been found, and all have been dry. Of the selected holes listed in table 4, 30 were deeper than 5,000 ft, and 15 were deeper than 10,000 ft. The deepest hole bottomed at 14,570 ft. Surprisingly, two of the shallow dry holes (fig. 12; table 4, holes 5, 8) were reported to have good shows of oil (Hendry and Sproul, 1966, p. 105). These two wells are located about 30 mi east of the easternmost of the Seven Roadless Areas. Oil stains also were found in a conglomeratic calcareous sandstone of the Norphlet Formation and in the Smackover Formation and in a Hunt Oil Co. dry hole (Schmidt and Clark, 1980, p. 73), located 30 mi westnorthwest of the westernmost of the Seven Roadless Areas.

Although no reasons for optimism about the discovery of oil and gas in and near the Seven Roadless Areas exist, the possibility cannot be completely ruled out. Oil and gas may occur in the Upper Jurassic Smackover Formation, which is present at depth in the Seven Roadless Areas (Applegate, Pontigo, and Rooke, 1978). Oil and gas are produced from this formation in the Jay field in the westernmost Florida Panhandle and in a nearby field in Alabama (Babcock, 1972). Therefore, geologists think that this formation has potential for oil in the Big Bend region. However, the several holes that have been drilled into the Smackover in parts of the Big Bend region east, south, and west of the Seven Roadless Areas have been dry (Applegate, Pontigo, and Rooke, 1978). Other reasons for not ruling out the potential for oil and gas discovery in the Seven Roadless Areas include the following: (1) the shows of oil in dry holes in the region, noted in the foregoing paragraph, (2) uncertainty as to whether or not formations older than the Smackover may contain oil and gas, and (3) the geology of the region, which is favorable for the occurrence of both structural and sedimentary traps (Applegate, Pontigo, and Rooke, 1978, p. 84).

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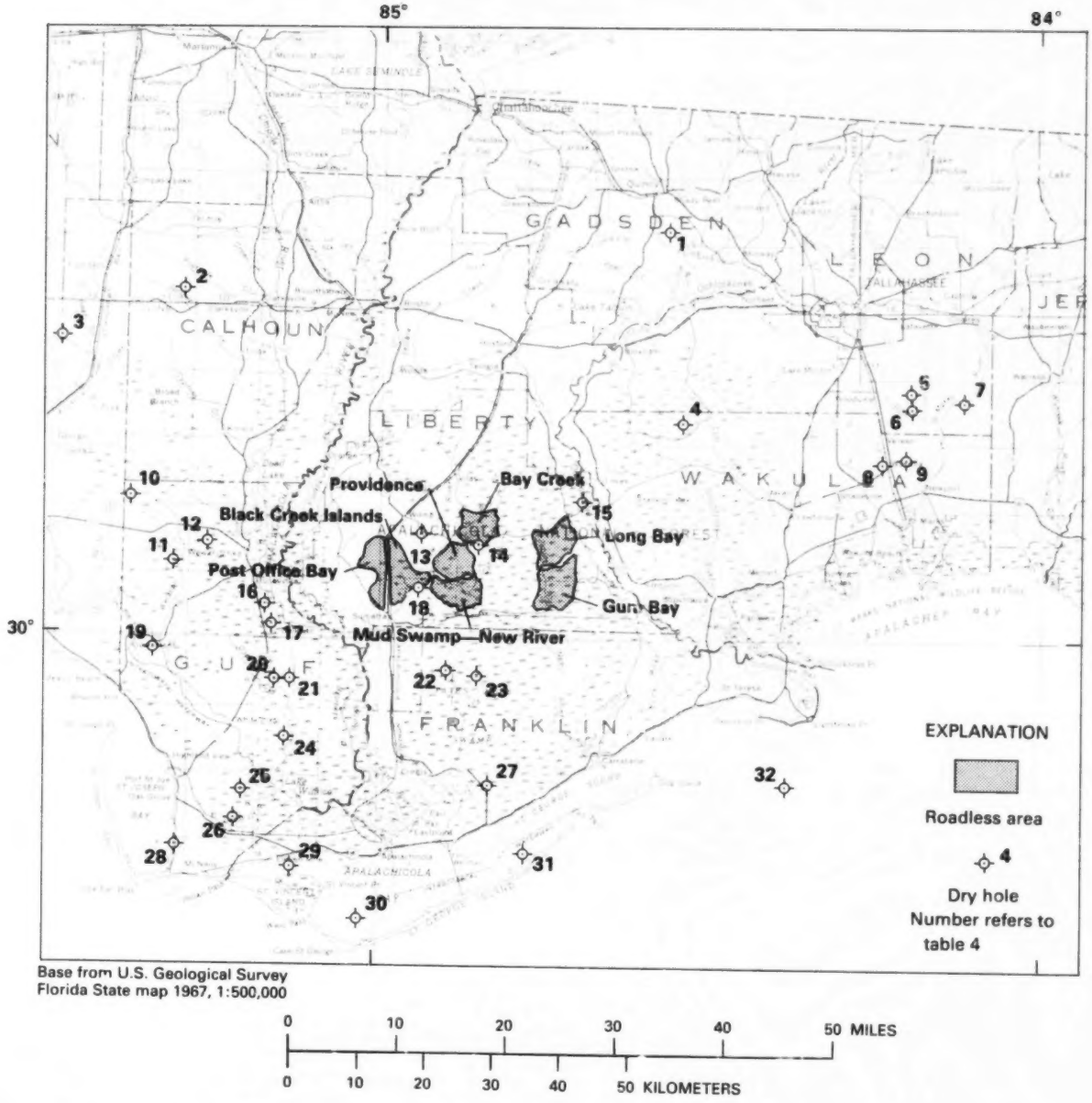

Figure 12. Locations of dry holes in the Big Bend region, Florida.

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Table 4. Selected exploratory oil and gas data for Apalachicola National Forest and surrounding region
[Source: Florida Bureau of Geology, oil and gas reports and records]

Florida Bureau of Geology number	Dry hole number, fig. 12	Company or owner's name	Dry hole or firm name	County	Sec.	T.	R.	Year of completion	Altitude of derrick floor above sea level (ft)	Total depth of hole (ft)
305	1	C. E. Prince	Examine Owenby	Gadsden	29	2N	3W	1963	197	7,021
149	2	Sun Oil Co.	#1 E. L. Jordan, et al	Calhoun	36	1N	11W	1953	100	5,002
246	3	Flamingo Oil Co.	---------- do ----------	Bay	18	1S	12W	1956	134	5,000
696	4	Placid Oil Co.	Placid Oil Co. No. 1 USA 27-2	Wakulla	27	2S	3W	1974	99	12,116
W32	5	Central Florida Oil and Gas Co.	Rhodes No. 1	Leon	11	2S	1E	1924	50	3,755
717	6	Phillips Petroleum Co.	St. Joe Paper Co. #1	-- do--	14	2S	1E	1974	33	10,466
W936	7	Stanolind Oil Co.	St. Joe Paper Co.	-- do--	15	2S	2E	1944	41	6,520
W12	8	Bonheur Development Co.	Cates No. 1	Wakulla	16	3S	1E	1919	17	2,169
W440	9	Ravlin Brown	V. G. Phillips No. 1	-- do--	14	3S	1E	1943	28	5,766
746	10	Hunt Oil Co.	International Paper Co.	Gulf	31	3S	11W	1974	81	13,284
48	11	Pure Oil Co.	#1 E. L. McMillan	-- do--	25	4S	11W	1947	44	5,069
846	12	Exxon Corp.	Neal Lumber and Mfg. Co.	-- do--	20	4S	10W	1976	59	13,587
769	13	Placid Oil Co.	Placid Oil Co. No. 1, USA, 10-3	Liberty	10	4S	7W	1975	75	12,654
745	14	---------- do ----------	Placid Oil Co. No. 1, USA, 16-2	-- do--	16	4S	6W	1974	74	12,400
730	15	---------- do ----------	Placid Oil Co. No. 1, USA, 26-4	-- do--	26	3S	5W	1975	62	12,131
W1469	16	Pure Oil Co.	Kate Gaskins No. 1	Gulf	19	5S	9W	1945	43	5,606
957	17	Mesa Petroleum Corp.	St. Joe Paper Co. Unit 29-4 #1	-- do--	29	5S	9W	1979	47	14,186
277	18	Gulf Coast Drilling and Exploration Co.	Gulf Coast Drilling and Exploration Co., No. 1, USA 16-2	Liberty	4	5S	7W	1959	49	10,010
40	19	Pure Oil Co.	St. Joe Paper Co. #3	Gulf	3	6S	11W	1946	11	5,025
W1470	20	---------- do ----------	---	-- do--	--	6S	9W	--	33	7,255
W914	21	---------- do ----------	---	-- do--	--	6S	9W	--	32	8,708
960	22	Mesa Petroleum Corp.	Buckeye Cellulose Corp.	Franklin	23	6S	7W	1979	87	12,885
814	23	Exxon Corp.	Buckeye Cellulose Corp. No. 16-3	-- do--	16	6S	6W	1976	50	11,950
134	24	Pure Oil Co.	---	Gulf	--	7S	9W	--	21	5,796
762	25	Charter Exploration Co.	St. Joe Paper Co.	-- do--	12	8S	10W	1975	22	14,570
670	26	---------- do ----------	---------- do ----------	-- do--	26	8S	10W	1973	34	14,290
32	27	Pure Oil Co.	Gex. and Lewin	Franklin	3	8S	6W	1946	15	5,060
37	28	Gulf Oil Co.	Pick Hollinger et al #1	Gulf	12	9S	11W	1946	14	5,656
43	29	Magnolia Petroleum Co.	Florida State Block 5-B	Offshore	--	--	--	1947	10	7,021
387	30	Mobil Oil Corp.	#1 C Florida State Lease 224-A	Offshore	--	--	--	1968	37	14,369
281	31	The California Co.-Coastal Petroleum Co.	Florida State Lease 224-A	Offshore	--	--	--	1959	26	7,031
293	32	---------- do ----------	---------- do ----------	Offshore	--	--	--	1961	34	10,560

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